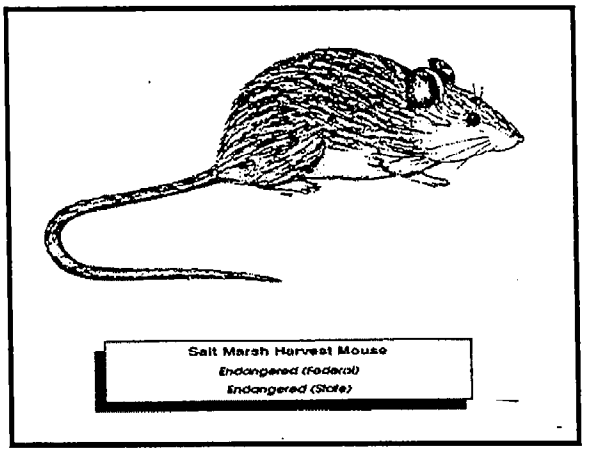
◆ SALT MARSH HARVEST MOUSE



INTRODUCTION

The salt marsh harvest mouse is associated with saline emergent wetlands. The population and distribution of this species have declined substantially, primarily as a result of reclamation of tidal salt marshes for agriculture, salt production, and urban development. The loss of habitat and declining condition of this species' population have warranted its listing as endangered under the State and federal Endangered Species Acts. The major factors that limit this resource's contribution to the health of the Delta are related to the adverse effects of historical and current loss or degradation of saline tidal wetlands that support the dense stands of pickleweed on which the salt marsh harvest mouse is dependent.

RESOURCE DESCRIPTION

The salt marsh harvest mouse occurs only in saline emergent wetlands associated with San Francisco Bay and its tributaries. Historically, these areas supported extensive tidal wetlands, which sustained dense stands of pickleweed. These plants, in turn, supported the salt marsh harvest mouse.

With the gradual development of the Suisun Marsh and San Francisco Bay areas came the construction of dikes and levees for flood control and protection of lands reclaimed for uses such as for salt ponds and agriculture. These reclaimed areas supported livestock grazing and, in the Suisun Marsh, small grain crops and asparagus. The vegetation growing beyond the limits of high tide supported grazing, and settlers found that if they diked those areas, wetland plants would eventually recede and give way to upland plants favored by livestock. As more and more settlers arrived, development resulted in the loss of large areas of habitat and severe fragmentation of the habitat that remained. Barriers, such as a road or path no more than 10 feet across, isolated the mouse in fragmented habitats because it would not use or travel across areas lacking vegetation. Upland areas consisting of grasslands or salt-tolerant plants that offered refuge during extreme high tides and high outflow periods were adjacent to the saline emergent wetlands. Development altered the landscape and geomorphology in many of these areas, which contributed to the loss of habitat.

Saline emergent wetlands with pickleweed occur only within the Suisun Marsh/North San Francisco Bay Ecological Management Zone of the Ecosystem Restoration Program Plan (ERPP) area. The elimination of much of the salt marsh harvest mouse's habitat is the primary cause of the species' decline. Other factors or "stressors" that have contributed to the decline or potentially could inhibit the recovery of the species include human activities that disturb the species and predation by non-native species. Grazing; water management practices; land use practices; contaminants; and human-made structures, such as dikes and levees, continue to degrade the quality of remaining habitat areas.

VISION

The vision for the salt marsh harvest mouse is to contribute to the recovery of this State- and federally listed endangered species through restoring salt marsh habitat in San Pablo and Suisun bays and adjacent marshes.

Existing occupied and unoccupied suitable habitat areas will be protected. Saline emergent wetlands will be restored. Stressors to the population and habitat will be reduced. New populations will be introduced into unoccupied habitat areas.

Protecting existing suitable habitat areas from potential activities that could adversely affect the

harvest mouse could be achieved through cooperative agreements with land management agencies, conservation easements, or purchase from willing sellers. Restoration of adjacent upland habitat will help to recover this species by increasing habitat area. Uplands provide the mouse with refuge from flooding.

Reducing factors that contribute to degradation of saline emergent wetland communities would promote natural restoration and maintenance. Increasing the quantity and quality of salt marsh harvest mouse habitat and reducing the adverse effects of stressors would establish conditions necessary to maintain existing populations and allow them to recover naturally. However, introducing the mouse into unoccupied habitat areas within its historic range would speed the recovery of the species by establishing new populations before the species would be expected naturally to expand into these or restored habitat areas.

Many programs are underway to restore the Bay-Delta salt marshes. Successful restoration program implementation will increase the chances of salt marsh harvest mouse recovery. Current land management practices need to be examined and redefined to restore, enhance, and promote salt marsh harvest mouse habitat. Salt marsh harvest mouse management strategies should focus on:

- managing known critical mouse habitat areas;
- providing additional research to identify other factors limiting the population and determine corrective measures; and
- addressing the needs of waterfowl and other migratory birds that also use saline emergent wetlands.

INTEGRATION WITH OTHER RESTORATION PROGRAMS

Existing restoration programs that would benefit the salt marsh harvest mouse include:

- Suisun Marsh Recovery Plan,
- San Francisco Bay Joint Venture,
- San Francisco Bay Area Wetlands Ecosystem Goals Project,
- California Coastal Conservancy,
- Delta Native Fishes Recovery Plan,
- California Department of Fish and Game Delta/Bay Enhanced Enforcement Program,
- Grizzly Island Wildlife Area,
- National Estuarine Reserve Research System,
- North Bay Wetlands Protection Program,
- San Francisco Bay National Wildlife Refuge, and
- Tidal Wetlands Species Recovery Plan.

Targets and actions will be coordinated through these programs.

LINKAGE WITH OTHER ECOSYSTEM ELEMENTS

Restoration of salt marsh harvest mouse is integrally linked with restoration of saline emergent wetlands and adjacent grasslands adjacent to San Pablo and Suisun Bays.

OBJECTIVE, TARGETS, ACTIONS, AND MEASURES

The Strategic Objective is to contribute to the recovery of at-risk native species in the Bay-Delta estuary and its watershed.

SPECIES TARGET: Maintain the current distribution and existing populations of salt marsh harvest mouse and establish and maintain viable species' populations throughout its historic range in the portion of the Bay Region within the ERP focus area.

LONG-TERM OBJECTIVE: Restore salt marsh harvest mouse to tidal marsh throughout their historical range.

SHORT-TERM OBJECTIVES: Reestablish populations in newly created or restored marshland and protect existing populations as outlined in the salt marsh harvest mouse recovery plan.

RATIONALE: This species is listed as endangered by both state and federal governments and exists in

small isolated populations in Bay salt marshes. Historically, about 107,000 acres of habitat suitable for the salt marsh harvest mouse existed. Degradation of habitat due to agricultural practices, diking, and human disturbance has limited greatly what is available today. It is important that this degradation and loss of any more habitat be stopped. Existing habitat is susceptible to flooding and silting in, as well as new building projects. New wetlands have to be created to outweigh disappearing marsh in other areas if the small isolated populations are to be enhanced. Created habitat would also benefit other species that use tidal marsh environments.

STAGE 1 EXPECTATIONS: Key items in the salt marsh harvest mouse recovery plan will have been identified, followed by implementation of those that would have immediate benefits to the species, including stopping population decline and increasing genetic flow between isolated populations. The existing populations will have been studied to determine their size and their habitat requirements. Limit the activities that would further increase erosion of Bay marshes and therefore reduce existing population sizes.

RESTORATION ACTIONS

The following general targets will assist in meeting the implementation objective:

- Increase the number of salt marsh harvest mice in San Pablo and Suisun Bay marshes.
- Reduce the extent of isolation among the mouse populations.

The following general programmatic actions will assist in meeting the targets:

- Increase the area of salt marsh adjacent to San Pablo and Suisun Bays.
- Decrease the extent of isolation among remaining salt marshes.
- Increase the amount of adjacent grasslands to the marshes.
- Reduce the degree of stressors including water management and land use practices on existing and restored marshes and adjoining upland habitats.

MSCS CONSERVATION MEASURES

The following conservation measures were included in the Multi-Species Conservation Strategy (2000) to provide additional detail to ERP actions that would help achieve salt marsh harvest mouse habitat or population targets.

- The geographic priorities for implementing actions to protect, enhance, and restore saline emergent wetlands and associated habitats for the California clapper rail should be: 1) western Suisun Marsh, 2) Gallinas/Ignacio marshes, Napa Marshes, and eastern Suisun Marshes, 3) Sonoma Marshes, Petaluma Marshes, and Highway 37 marshes west of Sonoma Creek, 4) Point Pinole Marshes, 5) Highway 37 marshes west of Sonoma Creek, and 6) the Contra Costa County shoreline.

- Coordinate protection, enhancement, and restoration of saltmarsh and associated habitats with other federal, state, and regional programs (e.g., the San Francisco Bay Area Wetlands Ecosystem Goals Project, and USFWS species recovery plans) that could affect management of current and historic habitat use areas to avoid potential conflicts among management objectives and identify opportunities for achieving multiple management objectives.

- Restore wetland and perennial grassland habitats adjacent to occupied nesting habitats to create a buffer of natural habitat to protect nesting pairs from adverse affects that could be associated with future changes in land use on nearby lands and to provide suitable foraging habitat and nesting habitat area suitable for the natural expansion of populations.

- Initial species recovery efforts should be directed to locations where there are immediate opportunities for protection, enhancement, or restoration of suitable habitat.

- To the extent practicable, design dikes constructed in enhanced and restored saline emergent wetlands to provide optimal wetland to upland transition habitat.

- To the extent practicable, direct ERP salt marsh enhancement efforts towards existing degraded marshes that are of sufficient size and configuration to develop fourth order tidal channels (marshes would likely need to be at least 1,000 acres in size).
- To the extent practicable, design salt marsh enhancements and restorations to provide low-angle upland slopes at the upper edge of marshes to provide for the establishment of suitable and sufficient wetland to upland transition habitat. Transition habitat zones should be at least 0.25 mile in width.
- Manage enhanced and restored habitat areas to avoid or minimize potential impacts on the salt marsh harvest mouse associated with recreational uses on lands acquired or managed under conservation easements.
- Direct restoration efforts towards restoration of lands adjacent to occupied habitat areas.
- Direct restoration efforts towards improving tidal circulation to diked wetlands that currently sustain partial tidal exchange.
- Direct some habitat enhancements and restorations towards increasing habitat connectivity among existing and restored tidal marshes.
- To the extent practicable, control non-native predator populations in occupied habitat areas and salt marshes enhanced and restored under the ERP.
- Control non-native invasive plants in existing salt marshes where non-native plants have degraded habitat quality and in salt marshes restored under the ERP.
- Monitor the use of restored salt marsh habitats by salt marsh harvest mice and the rate at which restored habitats are colonized.
- Acquire conservation easements to adjust grazing regimes to enhance wetland to upland transition habitat conditions.
- To the extent consistent with CALFED objectives, manage lands purchased or acquired under conservation easements that are occupied by the species to maintain or increase their current population levels.

REFERENCES

Multi-Species Conservation Strategy. 2000. CALFED Bay-Delta Program, Programmatic EIS/EIR Technical Appendix. July 2000.

Strategic Plan for Ecosystem Restoration. 2000. CALFED Bay-Delta Program, Programmatic EIS/EIR Technical Appendix. July 2000.

◆ SAN PABLO CALIFORNIA VOLE

INTRODUCTION

The San Pablo California vole is known to inhabit the salt marshes of San Pablo Bay. This species has declined, primarily as a result of the loss or degradation of its habitat. The loss of habitat has warranted its listing as a California Special Concern Species. The major factor that limits this resource's contribution to the health of the Bay-Delta are related to adverse effects of habitat loss.

RESOURCE DESCRIPTION

The San Pablo California vole is known exclusively from the salt marshes of San Pablo Creek, Contra Costa County, on the south shore of San Pablo Bay.

To a large degree, the decline of the San Pablo California vole can be attributed to the long-term cumulative effects of salt marsh habitat conversion and degradation. A combination of changes to salt marsh ecosystems has added to the problem. These changes include:

- loss of salt marsh habitat,
- agricultural activities such as discing and poisoning, and
- nonnative predators such as the red fox.

VISION

The vision for the San Pablo California vole is to contribute to the recovery of this California species of special concern and contribute to the overall species richness and diversity.

Achieving this vision will reduce conflict between protection for this species and other beneficial uses of land and water in the Bay-Delta.

INTEGRATION WITH OTHER RESTORATION PROGRAMS

Existing restoration programs that would benefit the San Pablo California Vole include:

- San Francisco Bay Joint Venture,
- Bay Area Wetlands Planning Group,
- California Coastal Conservancy,
- California Department of Fish and Game Delta/Bay Enhanced Enforcement Program,
- National Estuarine Reserve Research System,
- North Bay Wetlands Protection Program,
- San Francisco Bay National Wildlife Refuge,
- Tidal Wetlands Species Recovery Plan, and
- San Francisco Bay Area Wetlands Ecosystem Goals Project.

LINKAGE WITH OTHER ECOSYSTEM ELEMENTS

Restoration of the San Pablo California Vole is integrally linked with restoration of salt marsh habitat of San Pablo Bay.

OBJECTIVE, TARGETS, ACTIONS, AND MEASURES

The Strategic Objective is to contribute to the recovery of at-risk native species in the Bay-Delta estuary and its watershed.

SPECIES TARGET: Maintain the current distribution and existing populations of San Pablo California vole and establish and maintain viable species' populations throughout its historic range in the portion of the Delta and Bay Region within the ERP focus area.

LONG-TERM OBJECTIVE: Restore San Pablo vole to tidal marsh throughout their historical range.

SHORT-TERM OBJECTIVE: Determine the distribution and taxonomic status of the vole while maintaining existing salt marsh habitat know to contain populations. Undertake wetland restoration projects in and adjacent know populations to increase available habitat.

RATIONALE: The San Pablo vole is a California Department of Fish and Game Special Concern species. Although little is known about its distribution, biology, or taxonomy, it appears to be a distinct form that is confined to salt marshes and adjoining grasslands in Contra Costa County. To limit the decline of the populations even further, salt marsh and adjoining grassland habitats in Contra Cosa County need to be protected and further degradation and loss of habitat halted. Because present populations appear to be isolated from one another, there is a need to expand salt marsh habitats to maintain populations sizes and increase gene flow between the isolated populations.

RESTORATION ACTIONS

The following general programmatic actions will contribute to the recovery of the San Pablo California vole.

- Increase the area of salt marsh adjacent to San Pablo Bay.
- Decrease the extent of isolation among the remaining salt marshes in the San Pablo Bay region.
- Establish control measures for non-native predators within the habitat areas for the San Pablo California vole.

STAGE 1 EXPECTATIONS: All known localities for this species will have been protected and a thorough search made for other populations. A restoration plan will have been developed and implemented that includes genetic studies to determine its relationship to the widely distributed California vole.

MSCS CONSERVATION MEASURES

The following conservation measures were included in the Multi-Species Conservation Strategy (2000) to provide additional detail to ERP actions that would help achieve San Pablo California vole habitat or population targets.

- Coordinate protection, enhancement, and restoration of saltmarsh and associated habitats with other federal, state, and regional programs (e.g., the San Francisco Bay Area Wetlands Ecosystem Goals Project, and USFWS species recovery plans) that could affect management of current and historic habitat use areas to avoid potential conflicts among management objectives and identify opportunities for achieving multiple management objectives.
- Restore wetland and perennial grassland habitats adjacent to occupied habitats to create a buffer of natural habitat to protect populations from potential adverse affects that could be associated with future changes in land use on nearby lands and to provide habitat suitable for the natural expansion of populations.
- Manage enhanced and restored habitat areas to avoid or minimize potential impacts easements on the San Pablo California vole that could be associated with recreational uses on lands acquired or managed under conservation.
- To the extent practicable, acquire, restore and manage historic tidal salt marshes and surrounding lands occupied by the San Pablo California vole along the west side of Point Pinole to tidal marsh with sufficient wetland to upland transition and adjacent upland habitat to improve habitat conditions for the San Pablo California vole.
- To the extent practicable, control non-native predator populations in occupied habitat areas and salt marshes enhanced and restored under the ERP.
- Identify and implement feasible methods for controlling invasive non-native marsh plants.
- To the extent consistent with CALFED objectives, manage land purchases or acquired under conservation easement that are occupied by the species to maintain or increase their current population levels.

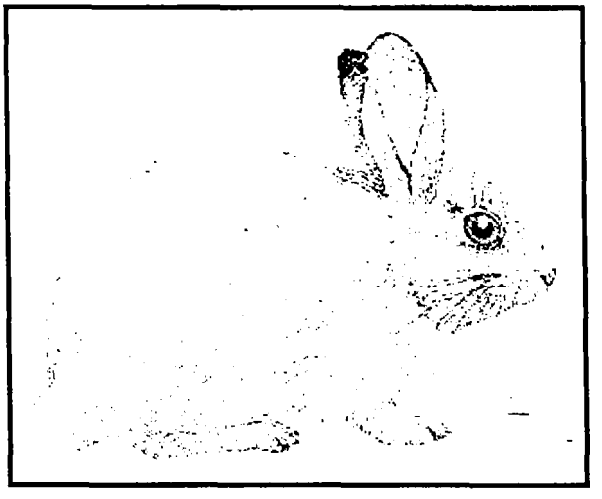
REFERENCES

Multi-Species Conservation Strategy. 2000. CALFED Bay-Delta Program, Programmatic EIS/EIR Technical Appendix. July 2000.

Strategic Plan for Ecosystem Restoration. 2000. CALFED Bay-Delta Program, Programmatic EIS/EIR Technical Appendix. July 2000.

Williams, Daniel F. 1986. Mammalian Species of Special Concern in California, Wildlife Management Division Administrative Report 86-1. June 1986.

◆ RIPARIAN BRUSH RABBIT



INTRODUCTION

The riparian brush rabbit is associated with riparian habitats of the Central Valley floodplain. It has been eliminated from the Delta from loss of riparian habitat. Elsewhere, the population and distribution of this species have declined substantially, primarily as a result of the loss or degradation of its habitat. The loss of habitat and declining populations have warranted its listing as endangered under the California Endangered Species Act and the federal Endangered Species Act.

The major factor that limits this resource's contribution to the health of the Delta is related to adverse effects of the historical loss and degradation of the mature riparian forests, on which the riparian brush rabbit depends, in the Delta and San Joaquin River floodplain.

RESOURCE DESCRIPTION

The remaining population of riparian brush rabbit is restricted to remnant San Joaquin Valley riparian forests with dense brushy understory. Unlike other rabbits, the riparian brush rabbit occupies riparian forests that have an ample brushy understory within natural floodplains. These floodplain riparian forests must be attached to suitable upland areas for cover and retreat from annual floods. Historically, this species' habitat was throughout the floodplain on the valley floor in northern San Joaquin Valley, including the Delta, but the original forest and floodplain have been reclaimed, cleared, altered, and degraded.

The remnant population of riparian brush rabbit is now restricted to 198 acres of remaining native riparian forest along the Stanislaus River in Caswell Memorial State Park in southern San Joaquin County in the East San Joaquin Basin Ecological Management Zone. It is considered the most sensitive mammal in California because of its susceptibility to floods, fire, disease, predation, disturbance, and flood control activities. The large-scale loss of riparian forest has resulted in over a 99% decline in the riparian brush rabbit population from historical levels. A population census conducted during January 1993, found that the population size ranged from about 210 to 310 individuals. Subsequent surveys following the January 1997 flood indicate that this species may be close to extinction. No brush rabbits were trapped in 22 nights of trapping between April 21 and May 30, 1997. In 1998, only one riparian brush rabbit was trapped (Federal Register 2000).

Overall, the decline of the riparian brush rabbit was caused by the destruction, fragmentation, and degradation of the San Joaquin Valley native riparian forest habitat. Less than 6% of the original habitat remains. Remaining suitable habitat is so severely fragmented that the rabbit has no means of naturally dispersing to other areas and establishing additional populations. Because the remaining riparian brush rabbit population occurs within one small area, any of the following events threaten the remaining population:

- Caswell Memorial State Park is subject to periodic flooding that often inundates the entire area. Without adequate cover on adjacent upland areas, the rabbits become easy targets for both native and non-native predators.
- The normal buildup of downed logs, dried vegetation, and ground litter in the riparian forest increases the potential severity of wildfires. Although this type of habitat is preferred and typically occupied by the riparian brush rabbit, any wildfire occurring within the remaining habitat could cause direct mortality as well as massive habitat destruction.
- Human activities have modified the habitat. The modified habitat has "selected" against the

riparian brush rabbit and for the desert cottontail. The desert cottontail presents two threats: one from competition and the other from diseases common to rabbits and carried by the species. These diseases are typically contagious and fatal; any disease becomes epidemic in this small and restricted population of rabbits.

VISION

The vision for the riparian brush rabbit is to contribute to the recovery of this federally and State-listed endangered species in the Bay-Delta through improvements in riparian habitat and reintroduction to its former habitat.

Restoring suitable mature riparian forest, protecting and expanding the existing population, and establishing new populations will be critical to the recovery of the riparian brush rabbit. Restoration of riparian habitats in the South Delta Ecological Management Unit of the Sacramento-San Joaquin Delta Ecological Management Zone and the East San Joaquin Basin Ecological Management Zone and adjacent upland plant communities will help the recovery of this species by increasing habitat area and providing refuge from flooding. Mature riparian forests with a brushy understory and adjacent upland habitat with sufficient cover during flooding would be suitable restored habitat. A healthy, brushy understory would contain:

- wild rose,
- blackberries,
- elderberries,
- wild grape,
- a buildup of downed logs,
- dried vegetation, and
- ground litter.

Restoring riparian habitat in the East San Joaquin Basin Ecological Management Zone to expand the area of suitable riparian brush rabbit habitat adjacent to occupied habitat along the Stanislaus River will help to protect and allow the existing population of brush rabbits to expand. Establishing additional populations within the riparian brush rabbit's historical range in the Sacramento-San Joaquin Delta Ecological Management Zone would help to avoid potential species extinction. To ensure the survival of introduced populations, newly occupied habitat areas should be suitable only for the riparian brush rabbit. That would reduce the likelihood of disease transmission from the desert cottontail. Hunting regulations should be modified to preclude hunting of rabbits and hares in and near reintroduction sites to limit the harvest of riparian brush rabbits until the species has recovered.

INTEGRATION WITH OTHER RESTORATION PROGRAMS

A Recovery Plan for Upland Species of the San Joaquin Valley, California has been developed which contains specific measures for the riparian brush rabbit (U.S. Fish and Wildlife Service 1998). Resources agencies have identified Christman Island, part of the San Joaquin River National Wildlife Refuge, as possessing the greatest potential for providing habitat needed by the riparian brush rabbit. The agencies also agreed to continue work to identify one or more other sites on public property along the San Joaquin River in Merced County for restoration and reestablishment of a third population of the riparian brush rabbit. The California Department of Fish and Game and the U. S. Fish and Wildlife Service should continue the interagency coordination and commitment necessary to halt the further loss and deterioration of habitat and begin restoration and preservation of suitable habitat deemed essential to maintaining the subspecies in perpetuity.

LINKAGE WITH OTHER ECOSYSTEM ELEMENTS

Restoration and protection of riparian brush rabbit is integrally linked with restoration of riparian forests and adjacent grasslands and reduction in wildfires and human disturbance in the northern San Joaquin Valley and the Delta.

OBJECTIVE, TARGETS, ACTIONS, AND MEASURES

The Strategic Objective is to contribute to the recovery of at-risk native species in the Bay-Delta estuary and its watershed.

SPECIES TARGET: Protect the Caswell Memorial State Park population; protect, enhance, and expand

the species' Caswell Memorial Park population; and restore four additional self-sustaining populations in the Delta and along the San Joaquin River by 2020.

LONG-TERM OBJECTIVE: Recover brush rabbit populations to the point where the species can removed from the state and federal endangered species list.

SHORT-TERM OBJECTIVE: Establish five additional self-sustaining populations of riparian brush rabbits along the San Joaquin River and in the Delta.

RATIONALE: The riparian brush rabbit a distinct subspecies of cottontail rabbit that historically lived in riparian areas along the San Joaquin River and Delta. It is listed as endangered under both the State and federal ESAs. It currently exists as one tiny remnant population in Caswell State Park that is in continuous threat of extinction. It has declined because of the loss of riparian habitats and the conversion of adjacent upland habitats to cropland. This species requires high ground, with extensive cover that it can move to when its primary riparian habitat floods. Due to the possibility of being extirpated by floods and wildfires it is important to develop other self-sustaining populations and restore riparian areas. Develop more brush habitat within the park to allow for good coverage and areas of minimal disturbance.

STAGE 1 EXPECTATIONS: The existing population will have been protected from further decline by protecting the species from seasonal flooding. More brushy riparian habitat within Caswell State Park will have been developed to provide good cover and areas of minimal disturbance. An inventory of potential restoration sites will have been completed and work begun on making them suitable for brush rabbit reintroduction. Due to low population numbers, the benefits and detriments of a captive breeding program will have been evaluated and implemented if the resource agencies find that captive breeding will prevent extinction of the species during the period that habitat is being restored.

RESTORATION ACTIONS

The following general targets will assist in meeting the implementation objective:

- Increase abundance in remaining population.
- Increase the number of rabbit populations
- Investigate the health of riparian brush rabbits in the existing population to determine the effect of non-native rabbit populations, if any, and take measures to improve their health if necessary.

The following general programmatic actions will contribute to the recovery of the riparian brush rabbit:

- Expand the amount of riparian forest in the northern San Joaquin Valley and the Delta.
- Increase the amounts of specific habitat features needed by rabbits in riparian forests where the existing population occurs or where introduced.
- Expand the amount of upland habitat adjacent to riparian habitat where the existing populations occurs or to where new populations will be introduced.
- Manage existing and new habitats to reduce potential threat of wildfire and human disturbance including hunting.
- Control predators and non-native competitors where populations exist or will be introduced.

MSCS CONSERVATION MEASURES

The following conservation measures were included in the Multi-Species Conservation Strategy (2000) to provide additional detail to ERP actions that would help achieve riparian brush rabbit habitat or population targets.

- Coordinate protection and restoration of riparian brush rabbit populations and its habitats with other federal and state programs (e.g., U.S. Fish and Wildlife Service species recovery plans) that could affect management of occupied and historic habitat areas to avoid potential conflicts among management objectives and identify opportunities for achieving multiple management objectives.
- Conduct surveys to identify suitable habitat areas for establishment of additional populations in the Delta and along the San Joaquin River and implement introductions to establish four additional populations in these areas by 2020.